An International Journal

computers & operations research

Editor: Samuel J. Raff

List of Contents and Author Index Volume 17, 1990



PERGAMON PRESS

OXFORD · NEW YORK · BEIJING · FRANKFURT · SÃO PAULO SYDNEY · TOKYO · TORONTO

computers & operations research

and Their Application to Problems of World Concern

editor

Samuel J. Raff 8312 Snug Hill Lane Potomac, MD 20854, U.S.A.

editorial advisory board

Vijay Aggarwal New Delhi, India **Donald Aucamp** Edwardsville, Illinois, U.S.A. Larry M. Austin Lubbock, Texas, U.S.A. Jonathan F. Bard Austin, Texas, U.S.A. Oded Berman Boston, Massachusetts, U.S.A. L. Bianco Rome, Italy Lawrence Bodin College Park, Maryland, U.S.A. Israel Borovits Tel Aviv. Israel R. L. Bulfin Auburn, Alabama, U.S.A. Wilfred Candler Washington, D.C., U.S.A. M. L. Chaudhry Kingston, Canada T. C. E. Cheng Winnipeg, Canada J.A. Chisman Clemson, South Carolina, U.S.A. Eng Ung Choo Burnaby, Canada **Brian Conolly** Cambridge, England Richard Deckro

Laramie, Wyoming, U.S.A.

(0865) 64881).

(Tel. Exeter (0392) 51558; Fax 425370).

Publishing Office: Journals Production Unit, Pergamon Press

plc, Hennock Road, Marsh Barton, Exeter EX2 8NE, England

Subscription and Advertising Offices: North America: Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, NY 10523, U.S.A.: Rest of the World: Pergamon Press plc,

Headington Hill Hall, Oxford OX3 0BW, England (Tel. Oxford

John Dinkel College Station, Texas, U.S.A. H.A. Eiselt Fredericton, Canada E.A. Elsayed Piscataway, New Jersey, James R. Evans Cincinnati, Ohio, U.S.A. J.O. Frendewey Houghton, Michigan, U.S.A. Moshe Friedman Coral Gables, Florida, U.S.A. Saul Gass College Park, Maryland, U.S.A. **Bezalel Gavish** Nashville Tennessee U.S.A. **Parviz Ghandforoush** Falls Church, Virginia, U.S.A. **Bruce Golden** College Park, Maryland, U.S.A. **Donald Gross** Washington, D.C., U.S.A. Jatinder N. D. Gupta Muncie, Indiana, U.S.A. Michael Hanna Houston, Texas, U.S.A. Edward L. Hannan Albany, New York, U.S.A. Michael Harnett Manhattan, Kansas, U.S.A. John Honig Bethesda, Maryland, U.S.A.

James P. Ignizio Houston, Texas, U.S.A. Jacob Intrator Ramat Gan, Israel James P. Jarvis Clemson, South Carolina. USA Mark H. Karwan Buffalo, New York, U.S.A. R. P. Koelling Blacksburg, Virginia, U.S.A. N.K. Kwak St Louis, Missouri, U.S.A. Lawrence LaForge Clemson, South Carolina, U.S.A. Santi B. Lahiri Winchester, Massachusetts, USA Judah Lando Haifa, Israel Gilbert Laporte Montreal, Canada Richard Larson Cambridge, Massachusetts, U.S.A.

Cecil E. Law Kingston, Ontario, Canada Kenneth D. Lawrence Basking Ridge, New Jersey, U.S.A. Reuven Levary St Louis, Missouri, U.S.A.

Jay Liebowitz Rockville, Maryland, U.S.A. Vahid Lotfi Buffalo, New York, U.S.A. Khalil Matta Notre Dame, Indiana, U.S.A. A. Mehrez Beer Sheva, Israel Hasan Pirkul Columbus, Ohio, U.S.A. **Gary Reeves** Columbia, South Carolina. USA Jeffrey Ringuest Chestnut Hill, Massachusetts, U.S.A. Mark Schniederjans Lincoln, Nebraska, U.S.A. Hanif D. Sherali Blacksburg, Virginia, U.S.A. Shigemichi Suzuki Tokyo, Japan Bernard W. Taylor III Blacksburg, Virginia, U.S.A. **Efriam Turban** Charleston, Illinois, U.S.A. Doug White Manchester, England E.P. Winkofsky Miamisburg, Ohio, U.S.A.

M. Zafer Yakin

New York, U.S.A.

Milan Zeleny

Holmdel, New Jersey, U.S.A.

annual subscription rates 1991

Annual institutional subscription rate (1991), DM 890.00; 2-year institutional rate (1991/92), DM 1691.00; a personal subscription rate for those whose library subscribes at the regular rate is available on request. Prices are subject to change without notice. Note: frequency changes to 8 issues/annum in 1991.

back issues

Back issues of all previously published volumes, in both hard copy and on microform are available direct from Pergamon Press offices.

published 6 issues/annum

copyright © 1990 Pergamon Press plc

It is a condition of publication that manuscripts submitted to this journal have not heen published and will not be simultaneously submitted or published elsewhere. By submitting a manuscript, the authors agree that the copyright for their a cle is transferred to the publisher if and when the article is accepted for publication. However, assignment of copyright is not required from authors who work for organizations which do not permit such assignment. The copyright covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microform or any other reproductions of similar nature, and translations. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, electrostatic, magnetic tape, mechanical, photocopying, recording or otherwise, without permission in writing from the copyright holder.

PHOTOCOPYING INFORMATION FOR USERS IN THE U.S.A.

The Item-fee Code for this publication indicates that authorization to photocopy items for internal or personal use is granted by the copyright holder for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service provided the stated fee for copyring beyond that permitted by Section 107 or 108 of the United States Copyright Law is paid. The appropriate remittance of \$3.00 per copy per article is paid directly to the Copyright Clearance Center Inc., 27 Congress Street, Salem, MA 01970.

Permission for other use. The copyright owner's consent does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific written permission must be obtained from the publisher for copying.

The Item-fee Code for this publication is 0305-0548/90 \$3.00+0.00

Pergamon Press plc Headington Hill Hall Oxford OX3 0BW, England Pergamon Press Inc.

Maxwell House, Fairview Park, Elmsford NY 10523, U.S.A.

[©]TM The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences-Permanence of Paper for Printed Library Materials, ANSI Z39.48-1984.

List of Contents

NUMBER 1

| | i | Softstrip® data strip containing the table of contents of this issue |
|---|-----|---|
| Chuen-Lung Chen and Robert L. Bulfin | 1 | Scheduling unit processing time jobs on a single machine with multiple criteria |
| Patrick G. McKeown and Cliff T. Ragsdale | 9 | A computational study of using preprocessing and stronger formulations to solve large general fixed charge problems |
| Alan Levine and David Finkel | 17 | Load balancing in a multi-server queuing system |
| Hani I. Mesak | 27 | Impact of anticipated competitive entry and cost experience on optimal strategic pricing of technological innovations |
| Cengiz Haksever and Jeffrey L. Ringuest | 39 | Computational efficiency and interactive MOLP algorithms: an implementation of the SIMOLP procedure |
| Erhan Erkut, Thomas Baptie and Balder von Hohenbalken | 51 | The discrete p-maxian location problem |
| Joseph Kreimer and Moshe Dror | 63 | The monotonicity of the threshold detection probability in a stochastic accumulation process |
| Hark Hwang, Dug Hee Moon and Seong Whan Shinn | 73 | An EOQ model with quantity discounts for both purchasing price and freight cost |
| James H. Bookbinder and Steven H. Edwards | 79 | School-bus routing for program scheduling |
| M. B. Wright | 95 | Speeding up the Hungarian algorithm |
| J. R. Rao and Nilima Roy | 97 | Use of tranquility in determining the numerical compensation for a fuzzy multicriteria decision making problem |
| Timothy D. Fry, Ronald D. Armstrong and L. Drew Rosen | 105 | Single machine scheduling to minimize mean absolute lateness: a heuristic solution |
| Ton Volgenant and Roy Jonker | 113 | Fictitious upper bounds in an algorithm for the symmetric traveling salesman problem |
| Hyo-Seong Lee | 119 | A short note on the Poisson input queuing system with start-up time and under control-operating policy |
| Call for Papers | - 1 | |

111

Announcement

NUMBER 2

i Softstrip® data strip containing the table of contents of this issue 123 Tests of efficiency in data envelopment analysis Jati K. Sengupta U. P. Wen and Y. H. Yang 133 Algorithms for solving the mixed integer two-level linear programming problem A. Friedlander, C. Lyra, 143 Optimization with staircase structure: an appli-H. Tavares and E. L. Medina cation to generation scheduling Y. L. Chen and Y. H. Chin 153 The quickest path problem Fred F. Easton 163 A dynamic program with fathoming and dynamic upper bounds for the assembly line balancing problem Christian N. Madu. 177 Coefficient of variation: a critical factor in Michael N. Chanin, maintenance float policy Nicholas C. Georgantzas and Chu-Hua Kuei John R. Current. 187 An interactive approach to identify the best Charles S. ReVelle and compromise solution for two objective shortest Jared L. Cohon path problems S. Selcuk Erengue and 199 A branch and bound algorithm for a single Yasemin Aksoy item nonconvex dynamic lot sizing problem with capacity constraints LeRoy F. Simmons, 211 Cycle regression analysis: simultaneous estimation Laurette Poulos Simmons, of trigonometric components of a time series Mayur Mehta and Vivek Shah A. Sciomachen and R. Sozzi 221 The algorithmic structure of a decision support system for a design of a district heating network Prabuddha De, Jay B. Ghosh 231 Scheduling about a common due date with earliand Charles E. Wells ness and tardiness penalties Call for Papers ı **Conference Announcement** 11 **NUMBER 3** i Softstrip® data strip containing the table of contents of this issue

F. A. Ogbu and D. K. Smith

| Michael Bastian | 255 | Lot-trees: a unifying view and efficient implementation of forward procedures for the dynamic lot-size problem |
|---|-----|--|
| Byong-Hun Ahn and Jae-Ho Hyun | 265 | Single facility multi-class job scheduling |
| D. C. Brauer and G. Naadimuthu | 273 | Office facilities planning considering organizational constraints |
| James DeArmon | 283 | Improving random number generators on micro-computers |
| Ram Gopalan, Rajan Batta and Mark H. Karwan | 297 | The equity constrained shortest path problem |
| J. M. Wilson | 309 | Compact normal forms in propositional logic and integer programming formulations |
| Rex K. Kincaid and Oded Z. Maimon | 315 | A note on locating a central vertex of a 3-cactus graph |
| T. C. E. Cheng | 321 | A note on a partial search algorithm for the single- machine optimal common due-date assignment and sequencing problem |
| | | NUMBER 4 Softstrip® data strip containing the table of contents of this issue |
| H. A. Eiselt and CL. Sandblom | 325 | Experiments with external pivoting |
| Prabuddha De, Jay B. Ghosh and Charles E. Wells | | CON due-date determination and sequencing |
| Claude Dennis Pegden and Matthew Rosenshine | 343 | Scheduling arrivals to queues |
| B. M. Rao | 349 | On the departure process of the split and match queue |
| Eng Ung Choo and Gin Hor Chan | 359 | Two-way eyeballing heuristics in dynamic lot sizing with backlogging |
| Tien Y. Kao and E. A. Elsayed | 365 | Performance of the LPT algorithm in multiprocessor scheduling |
| | | |
| A. Vernekar, G. Anandalingam and C. N. Dorny | 375 | Optimization of resource location in hierarchical computer networks |

Baiis Dodin and Mete Sirvanci 397 Stochastic networks and the extreme value distribution **Muhittin Oral** 411 Modeling outranking process as a mathematical and Ossama Kettani programming problem 425 A note on a proof of SPT optimality for single-T. C. E. Cheng machine sequencing problems via the transportation problem Call for Papers NUMBER 5 i Softstrip® data strip containing the table of contents of this issue Rajesh Srivastava 427 The location-routing problem: considerations in and W. C. Benton physical distribution system design C. Friden, A. Hertz 437 TABARIS: an exact algorithm based on Tabu and D. de Werra Search for finding a maximum independent set in a graph Peter C. Bell, Arshad A. Taseen 447 Visual interactive simulation modeling in a decision and Paul F. Kirkpatrick support role Youling Lin, Larry M. Austin 457 An implicit branch-and-bound algorithm for and James R. Burns mixed-integer-linear programming David Romero and 465 Methods for the one-dimensional space allocation Adolfo Sánchez-Flores problem George D. Tsiotres 475 A recursive methodology for the derivation of the and Hussein Badr blocking probabilities of tandem queues with finite capacity Geoffrey Bianchi and 481 A heuristic for a hybrid FLEET model Richard L. Church Maiachy Carey 495 Extending and solving a multiperiod congested network flow model Richard F. Deckro and 509 A goal approach to assembly line balancing Sarangan Rangachari Call for Papers 1

NUMBER 6

EXPERT SYSTEMS AND OPERATIONS RESEARCH

Samuel J. Raff v Preface

James P. Ignizio vii Foreword

| James P. Ignizio | 523 | A brief introduction to expert systems |
|--|-----|--|
| Paul N. Finlay | 535 | Decision support systems and expert systems: a comparison of their components and design methodologies |
| Jay Liebowitz | 545 | Introducing an expert systems course into the operations research curriculum |
| Robert R. Trippi and Efraim Turban | 553 | Auto-learning approaches for building expert systems |
| Tom M. Cavalier, Panos M. Pardalos and Allen L. Soyster | 561 | Modeling and integer programming techniques applied to propositional calculus |
| Don E. Deal, Jen-Gwo Chen, James P. Ignizio and V. Jeyakumar | 571 | An expert system scheduler: some reflections on expert systems development |
| Previous Special Issues | 1 | |
| Call for Papers | Ш | |
| Conference Announcements | ٧ | |
| | VII | Softstrip® data strip containing the table of contents of this issue |